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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/773,186

02/09/2004

Kia Silverbrook

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7590

11/07/2006

SILVERBROOK RESEARCH PTY LTD
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AUSTRALIA

EXAMINER

FIDLER, SHELBY LEE

ART UNIT

PAPER NUMBER

2861

DATE MAILED: 11/07/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/773,186

Applicant(s)

SILVERBROOK, KIA

Examiner

Shelby Fidler

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 August 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3,5,6,8,10-19,21,24,25,27,29-38,40,42-44 and 46-54 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3,5,6,8,10-19,21,24,25,27,29-38,40,42-44 and 46-54 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 2/9/2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date <u>6/21/2006</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Objections

Claims 12 and 31 recite the limitation "each element" in line 1. There is insufficient antecedent basis for this limitation in the claim. Please change to "each heater element."

Claims 15, 34, and 51 are objected to because of the following informalities: These claims recite the limitation "comprising a plurality of nozzle." However, according to the instant specification, the terms "bubble forming chambers" and "nozzle chambers" are used interchangeably. Since the "bubble forming chambers" have been disclosed in parent claim 1, please replace all recitations of "nozzle chambers" to "bubble forming chambers." Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 3, 5, 11, 12, 13, 19, 21, 24, 30, 31, 32, 38, 40, 42, 47, 48, and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. (US 4870433) in view of Lebens et al. (US 6631979 B2).

Regarding claims 1, 19, and 38:

Campbell et al. disclose an inkjet printhead comprising:

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a plurality of nozzles (nozzles 19; col. 3, lines 1-3 and col. 2, lines 17-21);

a bubble forming chamber (print cavity 21) corresponding to each of the nozzles respectively (Fig. 2);

at least one heater element (resistive heater elements 12) disposed in each of the bubble forming chambers respectively (Fig. 2), the heater element configured for thermal contact with a bubble forming liquid (ink; col. 3, lines 8-11); such that

heating the heater element to a temperature above the boiling point of the bubble forming liquid forms a gas bubble (bubble 22) that causes the ejection of a drop of an ejectable liquid through the nozzle corresponding to that heater element (col. 3, lines 8-13); wherein, the heater element has at least one bubble nucleation section (elongated portions 31), each bubble nucleation section having a smaller cross section than the remainder of the heater element (Figs. 2 and 3; as compared to end portions 32);

supplying the nozzle with a replacement volume of the ejectable liquid equivalent to the ejected drop (obvious to the cyclic ejections of col. 3, lines 3-7 and col. 4, lines 64-68); and

wherein the gas bubble collapses to a point of collapse that is spaced from any solid surface of the heater elements (col. 3, lines 60-64).

Campbell et al. do not expressly disclose that the heater element is in the form of a cantilever beam having a supported end and a free end.

However, Lebens et al. disclose a heater element (cantilevered element 20) in the form of a cantilever beam having a supported end (at anchored location 14) and a free end (free end portion 27; Fig. 10).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a heater element in the form of a cantilever beam into the invention of Campbell et

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al. The motivation for doing so, as taught by Lebens et al., is to operate the thermal actuator at reduced energy and acceptable peak temperatures (col. 2, lines 58-62).

Regarding claims 3, 21, and 40:

Campbell et al. also disclose that the bubble forming chamber (21) has a circular cross section (Fig. 1) and the heater element (12) has sections that are concentric with the circular cross section (Figs. 1-3).

Regarding claims 5, 24, and 42:

Campbell et al. also disclose that the bubble forming liquid and the ejectable liquid are of a common body of liquid (col. 3, lines 8-13).

Regarding claims 11, 30, and 47:

Campbell et al. also disclose that the heater elements (12) have two opposite sides (e.g. the sides relating to the top of Fig. 3 and bottom of Fig. 3) and are configured such that the gas bubble (22) formed by the heater elements are formed at both of the sides of the heater elements (col. 3, lines 50-60).

Regarding claims 12, 31, and 48:

Campbell et al. also disclose that the bubble (20), which each heater element is configured to form, is collapsible and has a point of collapse, and wherein each heater element is configured such that the point of collapse of a bubble formed thereby is spaced from that heater element (col. 3, lines 60-66).

Regarding claims 13, 32, and 50:

Campbell et al. also disclose a structure (substrate 18), wherein the nozzles (19) are incorporated on the structure (col. 3, lines 1-3 and Fig. 2).

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Examiner notes the limitation that the structure is formed by chemical vapor deposition. However, this limitation pertains only to the method of forming a device, which is not germane to the patentability of the device itself; therefore, Examiner has not given this limitation patentable weight.

Claims 6, 8, 10, 14, 25, 27, 29, 33, 43, 44, 46, and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. as modified by Lebens et al., as applied to claim 1 above, and further in view of Silverbrook (US 6019457).

Regarding claims 6, 25, and 43:

Campbell et al. as modified by Lebens et al. disclose all claimed limitations except that the printhead is a page-width printhead.

However, Silverbrook discloses a pagewidth printhead (head 200) configured to print on a page (col. 6, lines 7-12).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a pagewidth printhead into the invention of Campbell et al. as modified by Lebens et al. The motivation for doing so, as taught by Silverbrook, is to be able to print on the width of an A4 page (col. 6, lines 7-12).

Regarding claims 8, 27, and 44:

Campbell et al. as modified by Lebens et al. disclose all claimed limitations except that the heater elements are configured such that an actuation energy of less than 500 nJ is required to heat the heater element sufficiently to form the bubble in the bubble forming liquid, thereby causing an ejection of the drop.

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However, Silverbrook discloses heater elements (heaters 120; Fig. 10) that are configured such that an actuation energy of less than 500 nJ is required to heat the heater element sufficiently to form the bubble in the bubble forming liquid, thereby causing an ejection of the drop (200 nJ; col. 19, lines 8-9).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize heater elements that require less than 500 nJ to heat the heater element to eject a drop into the invention of Campbell et al. as modified by Lebens et al. The motivation for doing so, as taught by Silverbrook, is to allow power dissipation to be reduced without affecting print speed (col. 19, lines 9-10).

Regarding claims 10, 29, and 46:

Campbell et al. as modified by Lebens et al. disclose all claimed limitations except that the substrate surface has an areal density of nozzles exceeding 10,000 nozzles per square centimeter of substrate surface.

However, Silverbrook discloses a substrate surface wherein the areal density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square centimeter of substrate surface (using the reference measurement of Figure 43 and counting the individual nozzles disclosed in the "part of cyan" section of Figure 43, calculations show that the density exceeds 10,000 per square centimeter: $\frac{20 \text{ nozzles}}{0.0016384 \text{ cm}^2} = 12207 \frac{\text{nozzles}}{\text{cm}^2}$).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a printhead substrate surface with a nozzle density of 10,000 nozzles per square centimeter into the invention of Campbell et al. as modified by Lebens et al. The motivation for

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doing so, as taught by Silverbrook, is to provide four nozzles per pixel which would give up to 16 drops per pixel (co. 16, lines 60-62).

Regarding claims 14, 33, and 49:

Campbell et al. as modified by Lebens et al. disclose all the limitations of claim 1, and Campbell et al. also disclose a structure (substrate 18), wherein the nozzles (19) are incorporated on the structure (col. 3, lines 1-3 and Fig. 2).

Campbell et al. as modified by Lebens et al. do not expressly disclose that the structure is less than 10 microns thick.

However, Silverbrook discloses a structure (overcoat 142) that is less than 10 microns thick (col. 9, lines 8-10), wherein nozzles are incorporated on the structure (Fig. 11).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a structure incorporating nozzles that is less than 10 microns thick into the invention of Campbell et al. as modified by Lebens et al. The motivation for doing so, as taught by Silverbrook, is to provide increased levels of protection against the air (col. 9, lines 5-8).

Claims 15, 16, 18, 34, 35, 37, 51, 52, and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. as modified by Lebens et al., as applied to claim 1 above, and further in view of Anagnostopoulos et al. (US 6502925 B2).

Regarding claims 15, 34, and 51:

Campbell et al. as modified by Lebens et al. disclose all the limitations of claim 1, and Campbell et al. also disclose a plurality of bubble forming chambers (21) each corresponding to a respective nozzle (Fig. 2).

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Campbell et al. as modified by Lebens et al. do not expressly disclose a plurality of heater elements disposed within each bubble forming chamber, the heater elements within each chamber being formed on different respective layers to one another.

However, Anagnostopoulos et al. disclose a plurality of the heater elements (notch type heaters) disposed within a bubble forming chamber (col. 8, lines 36-37), the heater elements within each chamber being formed on different respective layers to one another (col. 8, lines 36-38).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a plurality of heater elements in each bubble forming chamber into the invention of Campbell et al. as modified by Lebens et al. The motivation for doing so, as taught by Anagnostopoulos et al., is to provide two heaters able to fire simultaneously or at different times (col. 8, lines 42-47).

Regarding claims 16, 35, and 52:

Campbell et al. as modified by Lebens et al. disclose all claimed limitations except that the heater elements are formed of solid material more than 90% of which is constituted by at least one periodic element having an atomic number below 50.

However, Anagnostopoulos et al., discloses heater elements formed of solid material more than 90% of which is constituted by at least one periodic element, having an atomic number below 50 (Ti and TiN, col. 10, lines 31-33).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize heater elements formed of Titanium and Titanium Nitride into the invention of Campbell et al. as modified by Lebens et al. The motivation for doing so, as taught by Chan (US

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5710070), is that the titanium/titanium nitride resistive layer provides good electro-migration performance to sustain high current density at high temperatures (col.3, lines 30-33).

Regarding claims 18, 37, and 54:

Anagnostopoulos et al. disclose heater elements covered by a conformal protective coating (passivation layer), the coating of each heater element applied substantially to all sides of the heater element such that the coating is seamless (col. 10, lines 33-39 in combination with Figure 5).

Examiner notes the additional limitation that the protective coating is applied simultaneously. However, this limitation pertains only to the method of forming a device, which is not germane to the patentability of the device itself; therefore, Examiner has not given this limitation patentable weight.

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a protective coating applied substantially to all sides of the heater element into the invention of Campbell et al. as modified by Lebens et al. The motivation for doing so, as taught by Anagnostopoulos et al., is to protect the heater from the corrosive action of the ink (col. 10, lines 35-37).

Claims 17, 36, and 53 rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. as modified by Lebens et al., as applied to claim 1 above, and further in view of DeMoor et al.

Regarding claims 17, 36, and 53:

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Campbell et al. as modified by Lebens et al. disclose all claimed limitations except that the heater elements are configured for a mass of less than 10 nanograms to be heated to cause ejection of a drop.

However, DeMoor et al. disclose heater elements configured for a mass of less than 10 nanograms to be heated (page 285, Fabrication: Ti thickness = 5nm; TiN thickness = 30nm; heater width = 2000 μ m; heater width = 0.4 μ m. Therefore, the volume of Ti within the heater is 4×10^{-12} cm³, and the volume of TiN within the heater is 2.4×10^{-11} cm³. Using the known densities of Ti = 4.54 g/cm³ and TiN = 5.22 g/cm³, the heater element has an entire mass of 0.14344 ng).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize De Moor et al.'s heater element mass into the invention of Silverbrook as modified by Campbell et al. The motivation for doing so, as taught by De Moor et al., is that these types of heaters show excellent resistivity uniformity and a low TCR value (page 293, Conclusions):

Response to Arguments

Applicant's arguments with respect to claims 1, 19, and 38 have been considered but are moot in view of the new ground(s) of rejection. Please see the above rejection to Campbell et al. in view of Lebens et al., which disclose heater elements as a cantilever beam having a supported end and a free end.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

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A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

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Communication with the USPTO

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shelby Fidler whose telephone number is (571) 272-8455. The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Meier can be reached on (571) 272-2149. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Shelby Fidler 10/31/06

Shelby Fidler
Patent Examiner
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STEPHEN MEIER
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